PCAS 15 (2012/2013)

Supervised Project Report

(ANTA604)

A review of the Health and Safety data from British Antarctica Survey (BAS) and Antarctica NZ (ANZ). The development of the Quick Stretching Guide (QSG) as a injury prevention strategy.

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Student ID: 76496416 words: 7584 (including Appendix and Abstract)

Abstract

In the Antarctic environment Health and Safety is of critical importance. Antarctica, being the coldest place on Earth with human occupation, physiologically challenges the human body. Injuries do occur due to the hostile cold environment. Injury prevention through stretching regimes is a Health and Safety strategy, which the author would like to see adopted as a injury prevention and mitigation strategy. Therefore the main outcome of this Project has been the development of the Health and Safety, Quick Stretching Guide (QSG).

This project investigated the Health and Safety data from Antarctica NZ (ANZ) and the British Antarctic Survey (BAS) and deduced, generalized and concluded that "strains and sprains" are the major musculoskeletal injury. The trend from the data demonstrated that "strains and sprains" were the dominant injury. This has resulted in the professional development of the QSG= Quick Stretching Guide.

The project also answers the three overarching questions of comparisons between BAS and ANZ and their Health and Safety. The questions being how are Health and Safety and Risk managed by two different National Antarctic Programs (BAS and ANZ). The different strategies that exist to minimize incidence of Health and Safety occurrences. Finally how the incidence reporting is being recorded.

The conclusions inferred from the data can be seen in the results section. In summary Health and Safety are managed reasonably similarly by BAS and ANZ. Similar strategies and reporting is being recorded.

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Acknowledgements

Without the data and assistance of Dr Neil Gilbert, Manager of Health Safety and the Environment Antarctica New Zealand and Mr Steve Marshall, Occupational Health and Safety Advisor to the British Antarctica Survey this project would not be possible. Neil and Steve's data and advice has been extremely helpful. I am exceedingly grateful for their time and effort.

Dr Daniela Liggett of Gateway Antarctica has also helped in this project and the PCAS course. I am very grateful for her kind help, generous availability and the incredible opportunity of learning about the amazing wilderness of Antarctica. To all who lectured to as at Gateway Antarctica and the department staff who have made the PCAS all possible. To my great classmates of PCAS 2013/14, it has been an epic time.

Lastly to my family, my own little Thomas and Giovanni for there "letting me" have the time "off" to do fulfill this dream of the PCAS, for all there sacrifice and patience. To my parents, who gave Thomas and I a place to stay while on PCAS. To my father, who although not wholly supportive is the reason why I have developed a deep love and respect for Antarctica and all its environs.

Introduction

The aim of this project; is to review the Health and Safety data from British Antarctic Survey, (BAS) and Antarctica New Zealand (ANZ) and the development of the QSG as a solution for injury prevention and Wellness. The QSG is designed on the basis of upper and lower body stretches with a broad generalized approach to stretching. The QSG is supported by background research illustrating the importance of stretching as a injury prevention tool to minimize "strains and sprains" or musculoskeletal injuries. The "strains and sprains" are also known as the Musculoskeletal Injuries. These are defined in International Accident Prevention Association (IAPA, 2007) Glossary of Health and Safety Terms as;

Musculoskeletal Injuries (IAPA, 2007); – Injuries to the system of muscles, tendons, ligaments, joints, bones and related structures of the human body. Also known as musculoskeletal disorders (MSDs).

Firstly treatment of injuries in the remote Antarctic environment often means help is immediately available. A problem surmounted with budget cut-backs. Treatment therefore the necessary neuro-musculoskeletal professional; such as a Chiropractor, Osteopath or Physiotherapist; may not be available even until the return back to the country of origin. In the case of ANZ operation at Scott Base, it relies heavily on the McMurdo facilities for Medical care. There is now no longer a Physiotherapist on staff at McMurdo Station this is due to US Government budget cut-backs, (pers.comm, Dr Mark Pederson MD, McMurdo, March 2014).

This project has two main parts;

Part 1: the analysis of the ANZ and BAS data and; the project aim of the development of a solution to injuries, this being the QSG.

Part 2: the answer to the three overarching questions.

Background Introduction to Part 1 – solution; stretching

Stretching can be seen as a injury prevention regime and a well-being enhancement protocol. Neurologically, the science of "neuroplasticity" has taught, "neurons that fire together, wire together, neurons that fire apart, wire apart". Essentially what has recently been discovered in neuroscience is that "Fitness and Exercise", which is what "Stretching" could be categorized into, leads to improvements in neuroplasticity, or simply the Brains "placidity" or malleability and resilience. In a study in 2009 on the theory of "neuroplasticity" it was concluded that;

"…different forms of exercise induce neuroplasticity changes in different brain regions," (Reynolds, 2009)

As well as increases in neuroplasticity and neurologically firing off of the action potentials, stretching has been proven to increase the flow of endorphins and therefore promote wellbeing. Endorphins appear to play a role in the behavioral concomitants of stress. In such capacity endorphins are suggested to function as modulators of neural systems that mediate the elaboration and expression of the reactive/affective components of stress. (Amira, 1980). Therefore the psycho-neuro-immunological benefits are being realized in the increased well being of the person stretching. Stretching for just a few minutes daily, has been proven to not only release

endorphins to improve your mental well-being, but also help your posture and increase your flexibility for a variety of activities. (mayoclinic.org)

Background Introduction to part 2 – 3 overarching Questions

The questions that this project will answer under part 2 are the following;

1. How are Health and Safety and Risk managed by two different National Antarctic Programs (BAS and ANZ)
2. The different strategies that exist to minimize incidence of Health and Safety occurrences,
3. How the incidence reporting is being recorded.

These questions above are answered with the table in the results section. In addition in answering how are Health and Safety and risk managed by 2 different National Programs; Essentially it can be seen that both ANZ and BAS have as their utmost goal the preservation of Health and Safety and risk mitigation and wellbeing of personnel. ANZ has the policy of "zero harm" and from the information researched it can be seen that instilling a "ownership culture" whereby "looking out for each other" and "owning ones owns actions" are a important part of Health and Safety (Appendix A). Antarctica NZ's Statement of Purpose and Values can see this, where Health and Safety is as a core value. Seen by the statement; "We have an uncompromising commitment to each other's safety". (Appendix A). Feedback is actively encouraged and learning from previous experiences to continuously improve performance. BAS safety culture instills a "emphasis of the importance of safety leadership, 'doing the job right when no one is looking". (pers comm, Steve Marshall BAS, 14/03/2013).The BAS safety culture also aims to be "mindful of hazard identification, follow safety controls, have the courage or leadership to speak up and take action when things are not safe" (Prezi.com, 2014, and Appendix B) .This is a safety system which BAS has centered around Procedures, Learning and Excellence. Figure 13, which can be seen in the discussion of the results.

Methods

Health and Safety data for the project was collected from Dr Neil Gilbert (Health Safety and the Environment Manager, ANZ) and Mr Steve Marshall (Occupational Health and Safety Manager, BAS).

In part 1 all the data given was analyzed and the relevant data was taken from the x-cel spreadsheets and conclusions made. This data is cited in the results section. The main conclusion being that "strains and sprains" (Musculoskeletal injuries) are the major injury of both BAS and ANZ. A solution to this "strains and sprains" injury prevention was then seen through the development of the Quick Stretching Guide-QSG.

Part 2 involved seeking the answers to the three overarching questions with the expert advice of Dr Neil Gilbert and Mr Steve Marshall. These results were then tabulated into a table in the results section. Other data such as board meeting minutes and policy statements of both ANZ and BAS were also consulted to deduce the overall picture

Results:

Part 1 : A brief review of Health and Safety Data from Antarctica NZ (ANZ) and British Antarctic Survey (BAS)

In analyzing the data from both BAS and ANZ where possible the results are comparatively presented with as close as possible a data set comparison.

Firstly a introductory overview the number of HSE reports is presented from ANZ and then in comparison to the BAS. (Figs 1-4). The BAS data (from figure 3) is from 1996 so comparative analysis is from then (not 1957 as in the ANZ data). The overall trend is a increase in reporting from both BAS and ANZ.

Figure 1: ANZ Number of HSE Reports (1957-2011)

(Antarctica NZ, (ANZ), 2014)

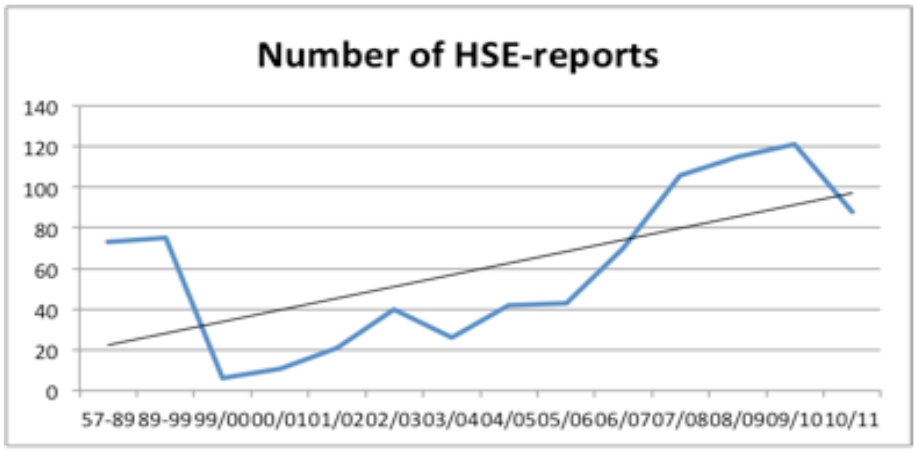


Figure 2: ANZ number of incidents by season (1957-2011)

(ANZ, 2014)

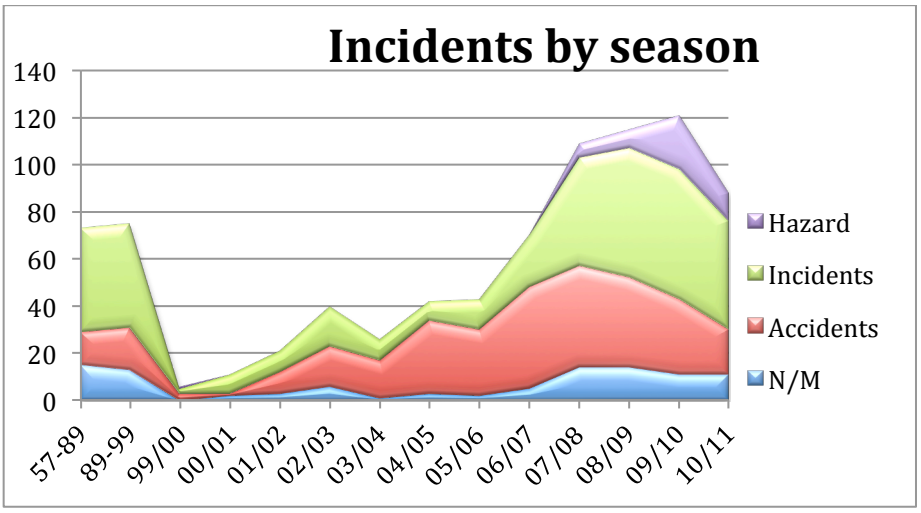


Figure 3: AINM and Environment reporting BAS 1996-2007

(British Antarctic Survey (BAS), 2014)

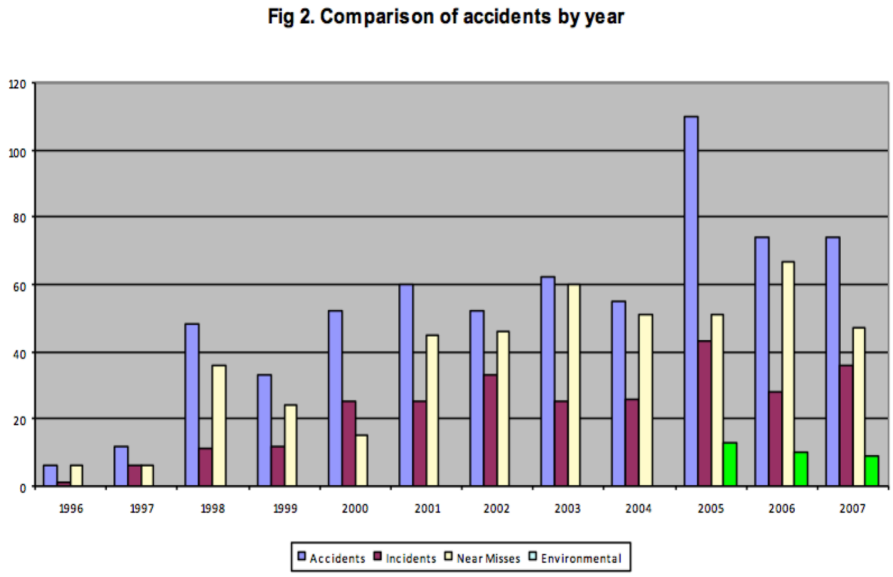
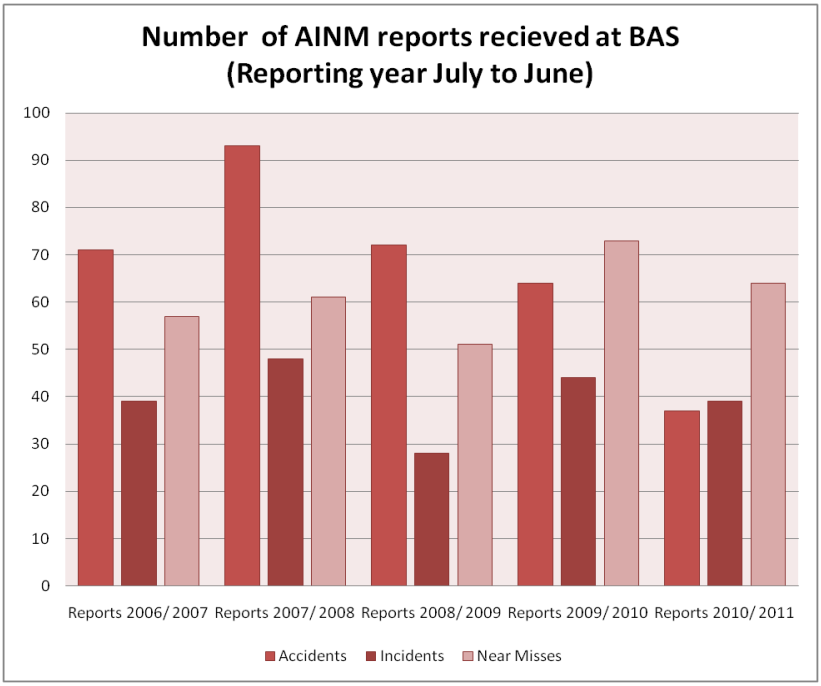


Figure 4: Accidents, Incidents and Near Misses BAS (2006-2011)

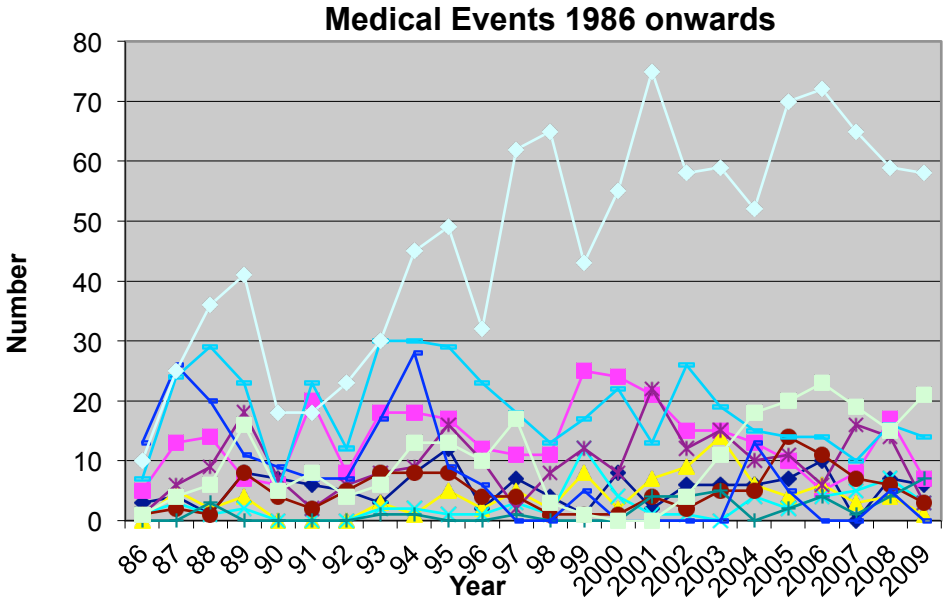
(BAS, 2014)



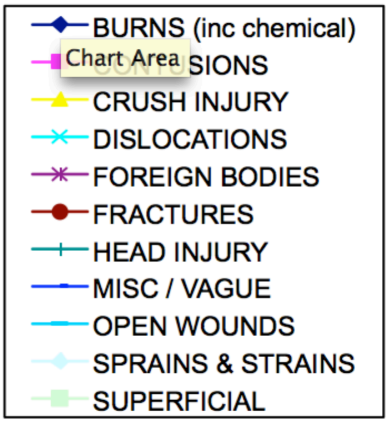
BAS have further categorized their data into “Medical Events”. This is a very useful categorization as is clearly interpreted. Key cited in Figure 5. BAS Medical Events illustrates strongly that “strains and sprains” are the main medical event. (Figure 5)

Figure5: BAS Data of Medical Events

(BAS, 2014)



Key to Figure 5 :



ANZ does not categorize its AINM into the same exact classification as BAS. However the following graphs (Figures 6 and 7) could show a similar trend of the dominance of “strains and sprains” in that if Injuries and slips/trips and falls some could further be categorized as “strains and sprains”. (pers.comm. Dr Neil Gilbert, email, 14/03/2014)

Figure 6: Levels of reporting of ANZ data by incident type (1957-2008)

(ANZ,2014)

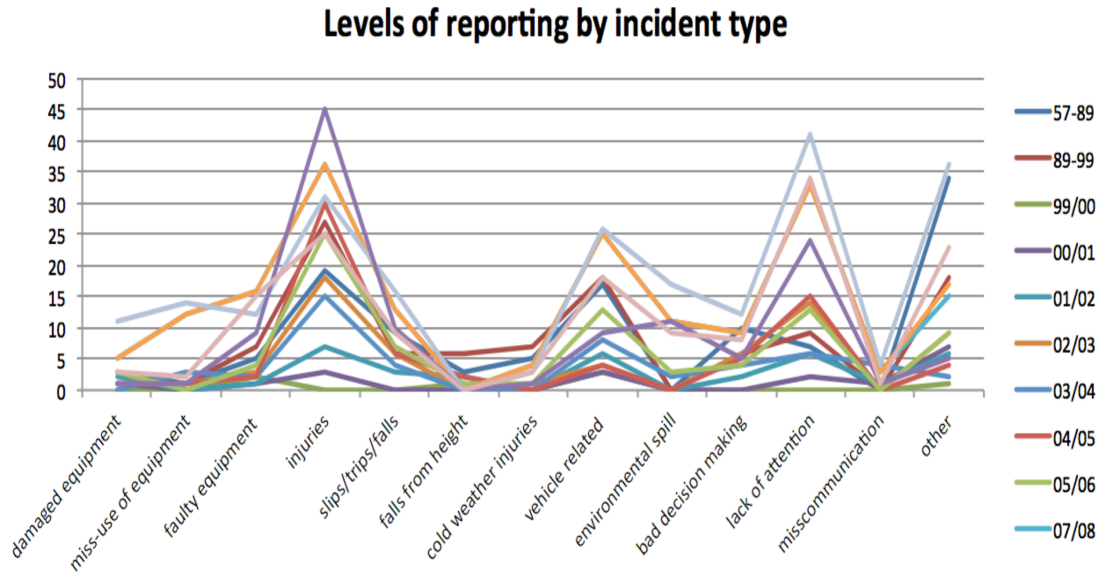
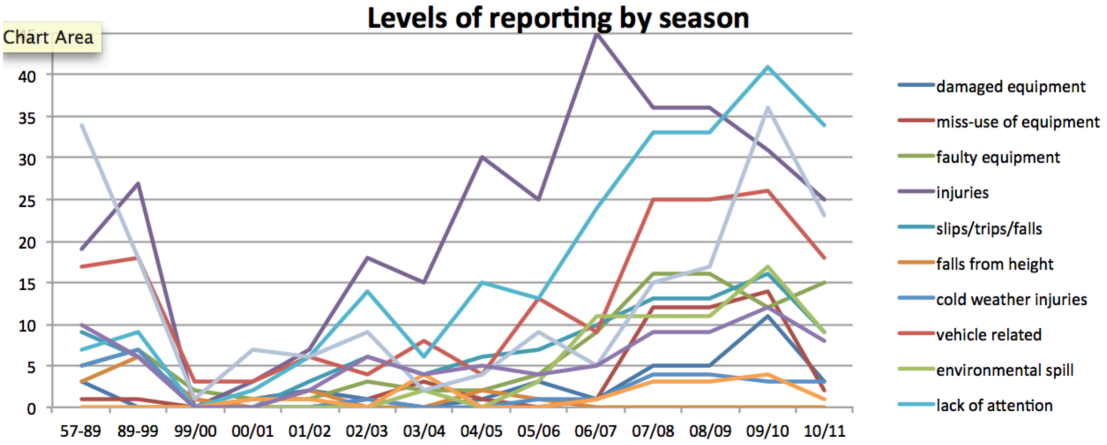


Figure 7: Levels of reporting by season (1957-2011)

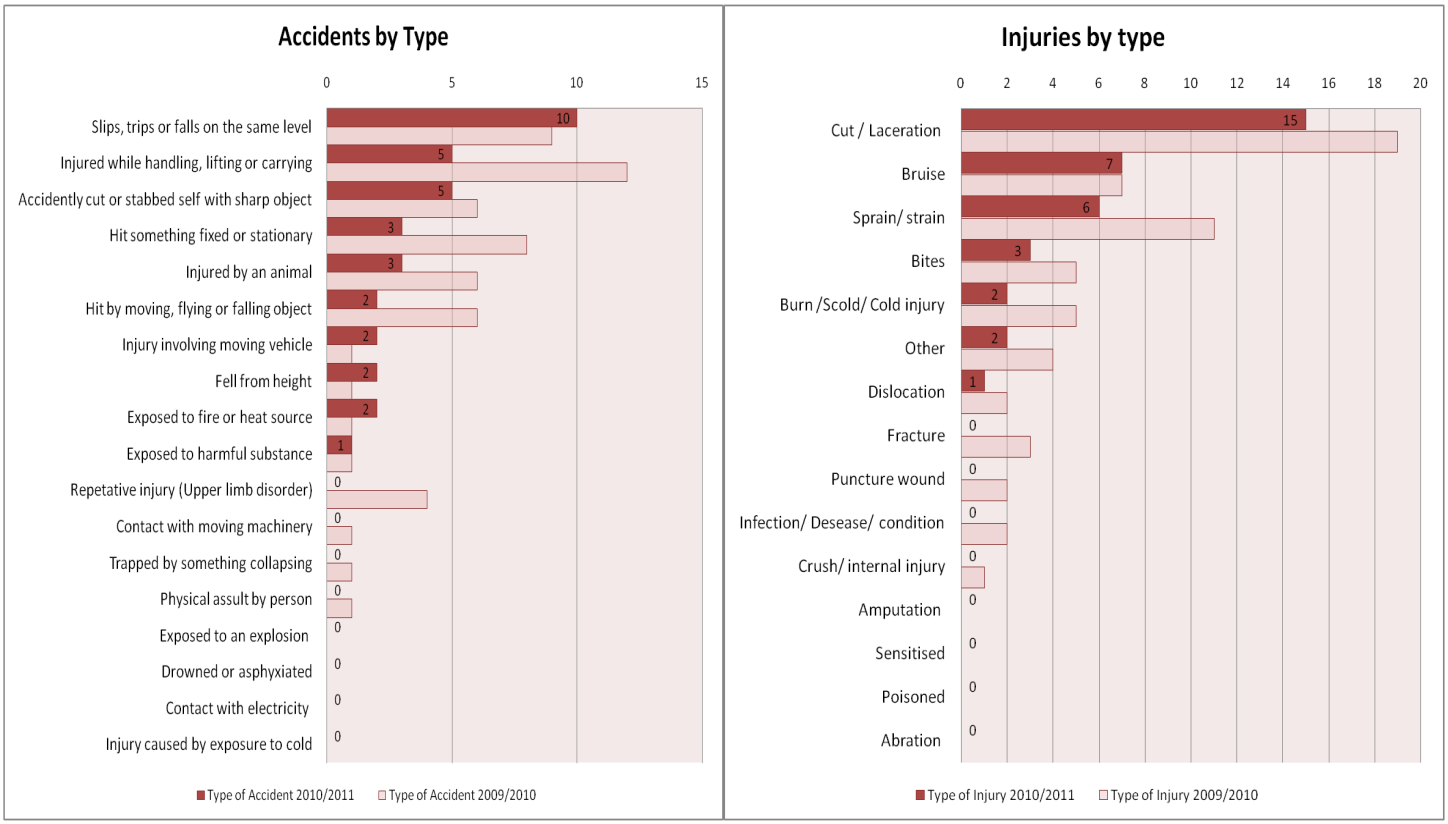
(ANZ, 2014)



Figures 6 and 7 shows a high incidence of injuries, slips/trips/falls. Lack of attention is also seen to be significant (however this has had a rapid decline since 2009/10 as has the injuries rate).

Figure 8: Accidents by type, BAS (2009-11) Figure 9: Injuries by type, BAS (09-11)

(BAS, 2014)



The data Figures 8-10 can be compared whereby the 2009-11 data for both ANZ and BAS shows slips/trips/falls to be significant in Figure 8, and in figure 10. Figure 9 also demonstrates "strains and sprains" to be significant.

Figure10: Reason for injuries by season.

(ANZ, 2014)

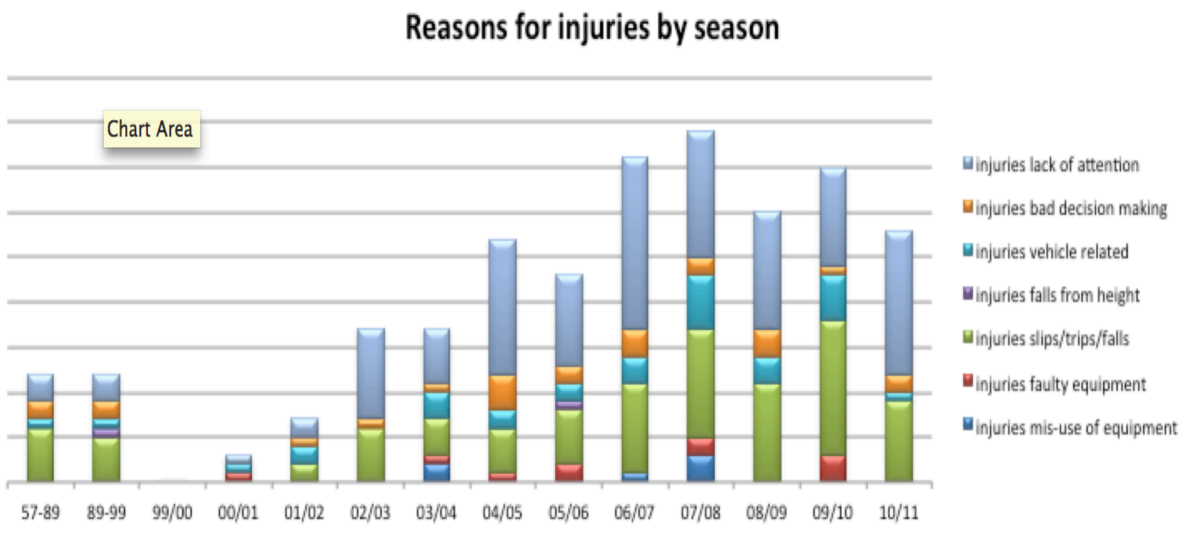


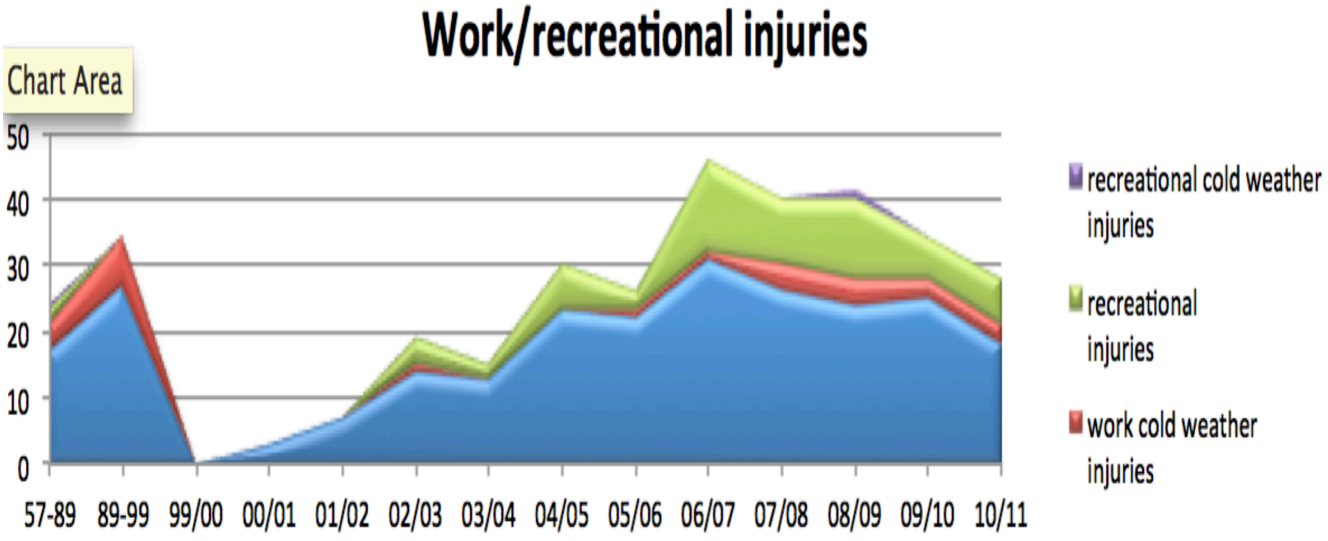
Figure 11: Injuries by season ANZ data

(ANZ, 2014)

This data in Figure 11 and 12 can be compared with the data in Figure 8 and 9. In figure 8 the Injury caused by exposure to cold is "0". In Figure 9 the cold injuries are grouped in with the scolds and burns.

Figure 12: Work/recreational injuries ANZ data

(ANZ, 2014)



A background definition of an Accident, Incident and Near Miss (AINM) in Heath and Safety is cited. (International Accident Prevention Association, (IAPA) 2007)

1. Accident: An unplanned event that results in harm to people, damage to property or loss to (IAPA, 2007) 2. Incident: An unwanted event, which, in different circumstances, could have resulted in harm to people, damage to property or loss to a process. 3. Near Miss: Any undesired event or condition where no injury, ill health, damage or other loss occurs. Examples would include: any non-compliance that could have led to an accident. (Imperial College London, 2014)

The analysis of figures 1-4 the overall presentation is that Accident and Incident and Near Miss (AINM) recording has increased. Both BAS and ANZ have seen significant improvement to the statistics of AIMA reporting and an improvement over the years to a openness of the culture. This has improved with the intranet use, which has created a good compliance and a "non figure-pointing" mentality. Intranet has created a culture whereby open reporting can occur. The number of injuries may also be proportionately increasing as the number of personnel visiting Antarctica may also be increasing, however there is a significant number of "strains and sprains" proportionately, and as mentioned reporting has been more diligent over the past 10 years.

From the BAS data of the "Medical Events" from 1986 onwards it is evident that the "strains and sprains" from 1992 onwards dominate the major Medical Event. (cited with the light blue line in Figure 5). "Strains and sprains" are a considerable greater number than any other of the "Medical Events". In 1993 seen as approximately 30, and at a peak in 2001 of approximately 75, and in 2009 seen as approximately 58 medical events. This BAS data is also in support of the same trend for ANZ, although the data from ANZ was not in exactly the same breakdown categories. After correspondence with Dr Neil Gilbert it was also revealed that the dominant medical event is "strains and sprain" and these being the musculoskeletal events (pers.comm Dr Neil Gilbert (ANZ), email, 09/04/2014). Therefore a solution is the development of the Quick Stretching Guide (QSG). To give added value to the QSG, from a fiscal viewpoint, financially researching the cost of the injuries could be worthwhile. It could be seen how the QSG could therefore be evaluated in its worth financially. This could be an area for future scope of study, to engage the interested parties such as BAS and ANZ and research this.

Figures 6 and 7 shows a high incidence of injuries, slips/trips/falls. Lack of attention is also seen to be significant (however this has had a rapid decline since 2009/10 as has the injuries rate). The summation here is that training and a "cultural shifting" to a "zero harm" diligent Health and Safety culture in ANZ has had positive results. The data in Figures 8-10 can be compared whereby the 2009-11 data for both ANZ and BAS shows slips/trips/falls to be significant in Figure 8, and in figure 10. Figure 9 also demonstrates "strains and sprains" to be significant. It is also of interest to note that "trips and falls" are the greatest here and some could most likely also fit into the "strains and sprains" category. Those injuries due to bad decision-making and lack of attention are also significant (Figure 10). It could be assumed that with training and preventative measures such as the QSG these injuries could be significantly reduced.

The cold weather injury data in Figure 11 and 12 can be compared with the data in Figure 8 and 9. In figure 8 the injury caused by exposure to cold is "0". In Figure 9

the cold injuries are grouped in with the scolds and burns. What is significant is that cold weather injuries are not that significant. Therefore the assumption could be made that the training and appropriate clothing and education has been adhered too. Compliance to cold weather injury prevention appears to be resulting in less occurrences. The significant factor in the ANZ data is that recreational activities proportionately do incur a significant amount of cold weather injury statistics. It would be interesting to analyze and compare the cold weather injuries of the BAS data set as has been conducted by ANZ. An interesting area to look at in the BAS data would be the occurrence of "recreational injuries". It is apparent that recreational activities from ANZ data are responsible for injuries, and the question could be asked here; What could be done to minimize this injury rate? Would the adoption and implementation of the QSG help?

In the future any comparative study should be comparing same data set, with data gathered under the same headings and for the same time periods (amount of time over the seasons) and the same categories. The adoption of a standard such as the IAPA Injury Analysis and Injury Frequency Rate (IAPA, 2007). These are listed to follow and would allow for a uniform standardized approach to the data.

Injury Analysis (IAPA, 2007)

– The process of systematically evaluating injury statistics to identify
Trends in such areas as:

Age, gender, occupation of those getting injured on the job
Part of body involved
Machinery involved
Process or work activity involved
Time of day
Location
Frequency (see injury frequency rate)
Severity (see injury severity rate)

Injury Frequency Rate (IAPA, 2007)

– The number of compensable injuries per 200,000 employee-
Hours of exposure. The following formula is used to calculate the injury frequency rate:
Number of Compensable Injuries X 200,000 Hours
Total Hours Worked

Injury Severity Rate
– A number that relates total days lost due to compensable
Injuries to the total hours worked during a specific period. The following formula is used to calculate the injury severity rate:
Number of Days Lost X 200,000 Hours
Total Hours Worked

Discussion: Why stretch? for injury prevention? To feel better?

The questions could be asked; Why Stretch? Is it for injury prevention? To feel better, for wellness?

It is known that stretching for just a few minutes daily, not only releases endorphins to improve your mental well being, but also helps posture and increases flexibility for a variety of activities.(Mayoclinic, 2014)
Stretching can help improve flexibility, and, consequently range of motion in your joints. Better flexibility may improve your performance in physical activities or decrease your risk of injuries by helping your joints move through their full range of motion and enabling your muscles to work most effectively. (Mayoclinic, 2014)

There is much debate about the evidence of stretching before, during and after exercise. From my research I infer that stretching is effective before exercise, during exercise and after exercise to maximize injury prevention. This in itself could also be a further scope of study with the QSG implementation, however it is beyond this projects objective. According to Woods, Bishop, and Jones (2007); "Warm up and stretches in the prevention of Muscular injury conveys that certain techniques and protocols have shown a positive outcome on deterring injuries"

Stretching is a important part of any exercise program. (Mayoclinic, 2014). Most aerobic and strength training programs inherently cause your muscles to contract and flex. Stretching after you exercise promotes equal balance a isometric balance. Stretching also increases flexibility, improves range of motion of your joints and boosts circulation. Stretching can even promote better posture and relieve stress.

Discussion: *the QSG as a injury prevention solution to "strains and sprains"*

The data analyzed has shown that the most common injuries from both BAS and ANZ are strains and sprains. The solution to strains and sprains injury prevention is the Quick Stretching Guide (QSG). The guide can be adapted and adapted for the injury types occurring. From analysis of the data this allows for carious versions of the QSG.

The QSG would be produced in the appropriate company colors and on durable paper in a format of as many panels as required. In the example shown there are six stretches but more can be added. The size is "pocket size" and this is approximately 60mmX100mm, approximately the size of a "smart phone" would be appropriate.

The intent would to make the QSG, easy, quick and fun to use.

Figure 13a: The Quick Stretching Guide (QSG)

Figure 13b: QSG in plan form –side 1

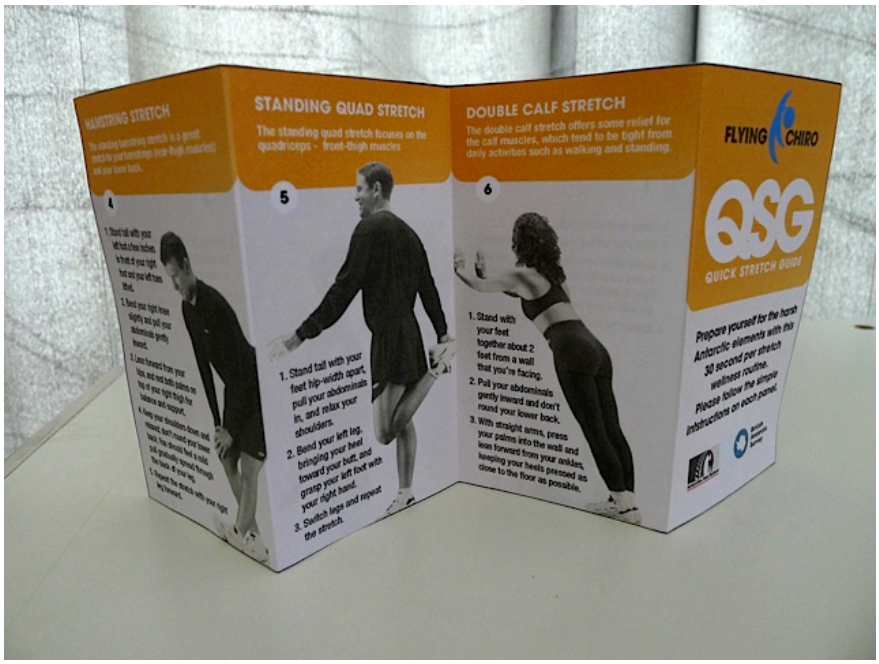


Figure 13c: QSG in plan form-side 2

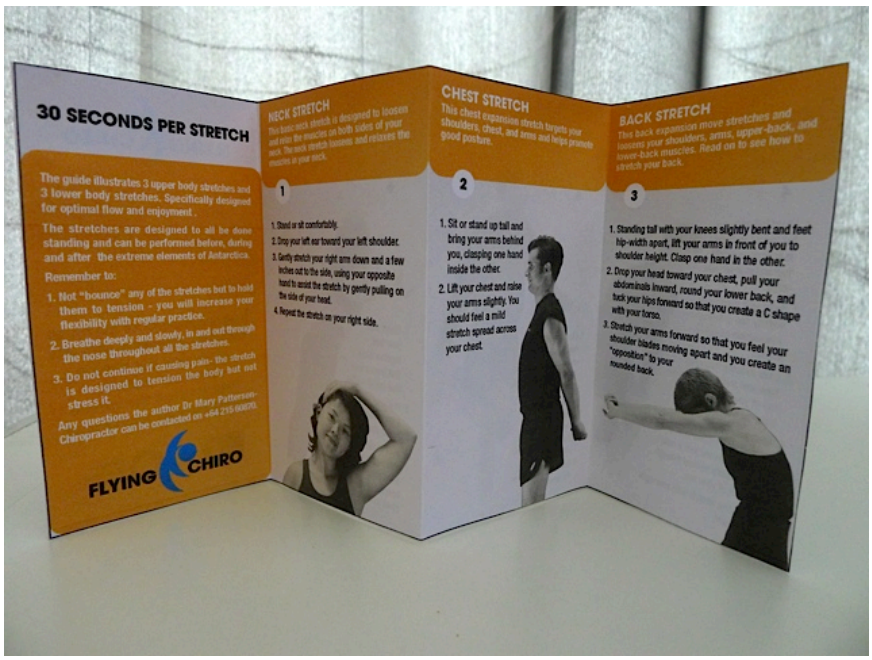


Figure 13d: QSG folded dimensions – front panel

Figure 13e: QSG folded dimensions – vertical view

Part 2- the three "overarching" questions;

Table 1: Health and Safety Management BAS and ANZ: Summary of Questions.

(pers.comm, Dr Gilbert, email, 13/03/04 and Mr Marshall , email 10/03/2014)

Organizations	Antarctica NZ	BAS
Q1. How are Health and Safety and Risk managed by 2 different National Antarctic Programs?	High priority on the health and safety of all those who travel to Antarctica through 1. a high standard of medical screening for all programme personnel; 2. dedicated training in New Zealand and Antarctica for all staff and programme personnel; 3. a risk based decision-making approach to all activities that are conducted in Antarctica (and Chch); 4. constant reinforcement of high safety standards by leaders throughout the organisation; 5. an organisational safety goal of zero harm; 6. regular incident reporting and investigation; (Pers.comm, Dr Neil Gilbert, 2014)	Safety Management System at BAS is accredited to the international standard BS OHSAS 18001. At the core of this system is hazard identification and a risk assessment process. The risk assessments identify the safety controls that must be implemented to manage a particular risk. For example regarding reducing injuries from manual handling, BAS first try to stop the need for manual handling by providing mechanical equipment and machinery to do all the lifting tasks on station. However this does not extend to the field where BAS still have a lot of lifting and carrying to do. Here we aim to reduce/restrict load sizes and ensure all loads are well marked with their weight. All loads to have good lifting points etc. The final control is staff training and awareness. All risks are managed in a hierarchy of control; 1.can we first eliminate the risk, 2. Can we introduce engineered controls?; 3. Can we reduce the hazard (safer chemical, lower weights); 4. Procedures, staff training and awareness; **1 generally being more effective than 4**. (pers.comm, Mr Steve Marshall, 2014)
Q2. ***The different strategies that exist to minimize incidence***	These Include: 1.Training; 2. Available tools such as our "Think Safety" booklet, risk assessment forms, decision making tools, hazard control plans, standard operating	1. safety management system 2. staff engagement programme to keep a good safety culture across our organisation. (Similar to NZ a pre-deployment training in

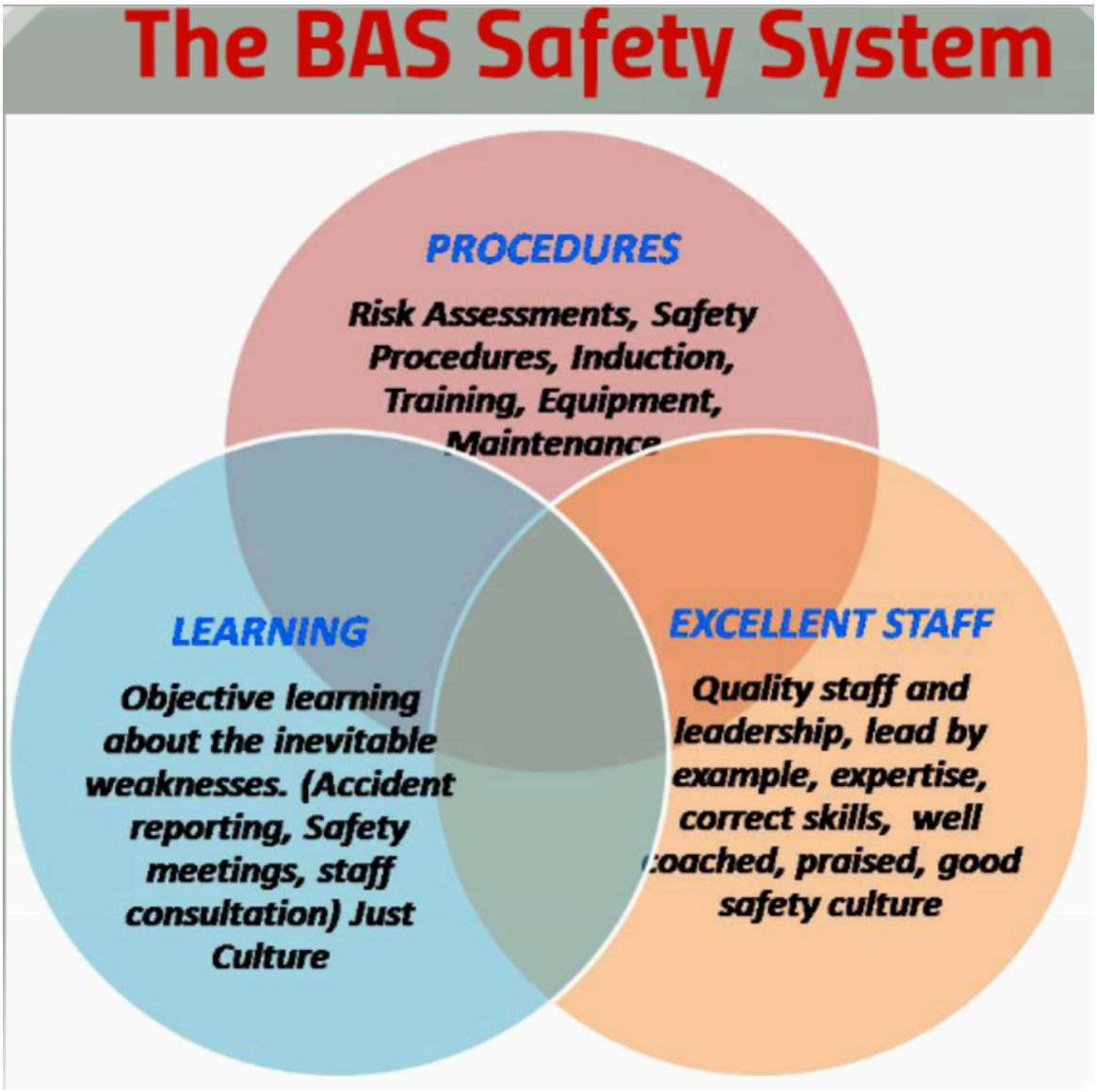
	procedures (SOPs); 3. Leadership; 4. A learning approach using incidents and investigations to prevent reoccurrence. (Pers.comm, Dr Neil Gilbert, 2014)	the UK followed by further training once at Station.) 3. A crucial element to the safety culture is 'safety leadership'. This is mostly lead by Base Commanders and Safety Officers across the operation. 4.emphasise importance of safety leadership 'doing the job right when no one is looking'. 5.monthly safety meetings at all stations and ships to consult with staff about safety matters. All staff are encouraged to get involved. 6.All safety leaders are trained to a minimum of 'IOSH managing safely' standard before deployment. 7.Internal auditing. Across our operation we conduct internal safety audits to confirm our work and practice is conforming to the expected legal standards. The audits also use the ISM Code (shipping) , ISBAO (aircraft) and 18001 (land) safety management standards to benchmark how well BAS is doing. Every 6 months BAS is subject to an external audit from a third party to provide assurance and maintain accreditation to the standards obtained.(pers.comm, Mr Steve Marshall, 2014)
Q3. ***How is incidence reporting being recorded?***	Electronic incident reporting tool for incident, hazards and near-misses. Data is obtained from this and reported to the Senior Leadership Team and the Board as well as externally. (Pers.comm, Dr Neil Gilbert, 2014)	Online system (for approx.12 years).This has been a great success and is also the tool used to investigate and learn from incidents. These learning points are then fed back into the risk assessment process. BAS also uses the online reporting system for recording all Antarctic training exercises such as Major Incidents, fire, SAR, Environment etc. (pers.comm, Mr Steve Marshall, 2014)

Discussion of Part 2

There is an overall similar approach between BAS and ANZ (to the three overarching questions) with a openness to Health and Safety and a learning culture. The Intranet encourages the reporting of the health and safety data and occurrence reporting has increased in both ANZ and BAS in the past decade. This is by no means indicative of a increase in the actual occurrences but rather a increase in reporting and thoroughness, as previously discussed and evidenced by Figures 1-4 in results.

To be effective in Health and Safety Management in Antarctica, safety programs must stress upfront risk assessment during design and planning phases. Also the concept of setting priorities must continually be reinforced. Figure 15; illustrates the overarching structure of BAS's management structure, of how Health and Safety and Risk are managed. Risk Assessments are and important part of preventative injury procedures.

Figure 15: The BAS safety System



(Marshall, 2014)

The BAS safety system shown how the Procedures, Learning and Staff are all interconnected. The procedures are implemented by the staff who are always learning via, experience, meetings and reporting.

In answering the three overarching questions, Accountability is an issue surrounding Health and Safety. In looking at Accountability within BAS Figure 16 shows the structure.

Figure 16: Who is Accountable for Health and Safety with BAS.

(Marshall, 2014)

In the Health and Safety Policy Statement (Appendix B), it states the British Antarctic Survey (BAS), a component body of the parent organization, Natural Environment Research Council (NERC). This Policy explains present hazards not normally encountered outside of polar environments. This in turn requires managers and staff to maintain a high degree of safety awareness. Therefore seeking to develop and maintain a pragmatic, positive, open culture where health and safety are recognised by all staff to be fundamental in all actions. This safety awareness is also very much a part of ANZ with the maintenance of a pragmatic, positive and open culture.

The following statement illustrates this pragmatic, positive open culture;

Referenced from the (BAS 2010-11, Annual Board Review);

“Year 10/11 has again seen good involvement and commitment from BAS staff and mangers. All safety meetings were held as required and the general content/ attitude of meetings are appropriate to the level of risks involved.” (BAS, 2010-11).

ANZ furthermore has a open culture with the Zero Harm focus and whereby incident reporting via the online intranet is encouraged. Strategies of “looking out for each other” and learning from the occurrences via discussion and case-study are supported. An openness to learning is adopted with a respectful rather flat non-hierarchical structure at ANZ (Author observation at Scott Base, PCAS 2014) There are leaders that are available to report too. All are very approachable; therefore there is a non-hierarchical approachableness. ANZ has a staff of approximately 30 permanent in Christchurch, one base on continental Antarctica, a budget of approximately 30million NZD. (pers.comm, Dr Ed Butler, 12/11/2013). BAS has a staff of 400+personnel , three bases on continental Antarctica and a budget of approximately 50million. (Wikipedia, 2014). The comparison is of great contrast in personnel and budget but yet the same crucial underlying values exist. That of exceptional standards of Health and Safety for all personnel.

Auditing being a essential part of accountability take place regularly at BAS and ANZ, both within and at a Board level. The Board meetings are an essential component to the accountability. Health and safety auditing is a process allowing BAS and ANZ to review and continuously evaluate the effectiveness of their safety management systems. BAS has 3 categories for health and safety audits: Ships ISM Auditing**,** Aircraft operations IS-BAO Auditing and General Health and Safety Management BS 18001 OHSAS Auditing. ANZ

Ultimately personnel accountability is to each other for Health and Safety and the up holding of “Zero Harm” . However due to wider fiscal responsibilities there is a large component of accountability to the Crown and ultimately to the Tax payer, therefore the auditing process is transparent and trustworthy.

Conclusions

Without a regard for Health and Safety, Science, being a primary objective of Antarctica cannot exist.

British researchers, John Dudeney and David Walton, released a study concluding that New Zealand's sphere of influence in Antarctica, based on counts of policy papers and scientific publications, is greater than any other country on the basis of the population that supports it. (BAS 2011/12 , annual report, p5).
This could also be expressed with the intertwining of policy and science as referenced in O'Reilly, 2008; "Antarctic expert communities coalesce in the making of procedures, documents and audiences…this continent of peace, science and other exceptionalism is crafted as a technocratic wilderness" (O'Reilly, 2008)

New Zealand, by shear virtue of its geographical position has as great a role to play as any Nation leading the way in Science and Health and Safety Antarctica. This project has shown that there is a future for further research into the area of injury prevention and for the possible implementation for injury prevention and wellness regimes such as the Quick Stretching Guide (QSG).

As stated previously progress in the area of Health and safety reporting has lead to major improvements in minimizing risk as reporting in both ANZ and BAS has improved vastly over the past decade.

It is concluded from this project that "strains and sprains", (musculoskeletal injuries) are the dominant injury type. A solution to this problem is the development of the QSG. This offers a preventative, wellness solution to the issue of musculoskeletal injuries. The QSG would first be introduced at the Induction stage from the viewpoint of aiming to prevent injuries. It would then be re-introduced at the Antarctica Field Trainings (AFT).

As mentioned the cost of Health and Safety is difficult to measure fiscally and it would be worthwhile to look at modeling financially the cost of the injuries. This would enable the QSG to therefore be evaluated in its worth financially. This could also be an area for future scope of study, to engage the interested parties such as BAS and ANZ and research the outcomes of the QSG implementation.

If further research was to be conducted comparing BAS and ANZ data sets then it would be advisable to collect the data in exactly the same categories. As explained previously in the Discussion of part 1:,Injury Analysis (IAPA,2007). With the information data sets being wide and vast it is imperative to be specific and ask the same questions for accurate analysis.

Managing safety and health in Antarctica creates challenges beyond those encountered in domestic industry. The challenge of developing a safety program in such a diverse, dynamic environment is vast and complex. To succeed, safety work on this isolated continent requires continuous risk assessment, processes evaluation and decision-making. This project has highlighted the exceptional performance and procedures of ANZ and BAS. Adding the QSG and its training to BAS and ANZ would embellish already exceptional Health and Safety standards. It is the author's ambition to see the implementation of such a guide, to enhance wellbeing and prevent and mitigate musculoskeletal injuries.

Appendix A: Antarctica New Zealand Vision:

Antarctica and the Southern Ocean: valued, protected, understood. Purpose: To further New Zealand's strategic influence and interests in relation to Antarctica and the Southern Ocean.

Values: We are a high performing organization underpinned by a culture of shared beliefs. These are: Safety: We have an uncompromising commitment to each other's safety. Sustainability: We will incorporate principles of social, environmental and financial sustainably into all that we do. Learning: Feedback is actively encouraged and we will learn from previous experiences to continuously improve our performance. Professionalism: We do the job right every time through adherence to strong operating disciplines.

Health, Safety and Environment Policies and Procedures

Health, Safety & Environment Policy

Antarctica New Zealand is committed to maintaining the health and safety of all employees and participants in the New Zealand Antarctic Programme, including contractors.

Health and Safety is a core value and the highest organizational priority.

All injuries and occupational incidents are preventable and we have set a goal of "zero harm" that we are constantly striving to achieve. Zero harm means:

– Zero injuries
– Zero work-related illnesses

We aim to be at least compliant with and where possible exceed the requirements of the New Zealand Health and Safety in Employment Act (1992) as well as the AS/NZ health and safety standard 4801.

Policy Expectations

To achieve our goals, we will, in all our activities and operations:

i. Observe and practice safe work methods.
ii. Ensure safety equipment is used correctly at all times.
iii. Integrate our health and safety policy with our Risk Management strategy.
iv. Encourage participation by stakeholders and employees in the identification and management of hazards; the reporting of incidents, and the identification of ways to improve our safety performance.
v. Investigate reported incidents where necessary to ensure that appropriate corrective actions are taken to prevent recurrence and improve our performance.

vi. Design and operate our facilities in a manner that enhances the health, safety and security of all New Zealand Antarctic Programme participants.
vii. Openly consult, discuss and review our practices and performance, good or bad.
viii. Give recognition to those that contribute to improved health, and safety performance. Antarctica New Zealand Page 2 Health and Safety Policy 1 – Health and Safety 2013
ix. Establish and run Health and Safety Committee's in Christchurch and at Scott Base for the purpose of fostering good practices and providing opportunities for employees to participate in the on-going process of improving our health and safety system.
x. Provide a secure working environment by protecting ourselves, our assets and our operations against risk of injury, loss or damage.
xi. Ensure that all employees, contractors and New Zealand Antarctic Programme participants are well informed, well trained, engaged in and committed to achieving our safety goals and understand that no activity is so important that it cannot be done safely.
xii. Regularly provide assurance that the processes in place are working effectively. While all Antarctica New Zealand employees, contractors and New Zealand Antarctic Programme participants are responsible for health and safety performance, managers are accountable for understanding and managing health and safety risks.
xiii. Fully participate in hazard identification and risk assessments, audit assessments and reporting of health and safety results.
xiv. Maintain public confidence in the integrity of our operations; openly report our performance and consult with people outside the organisation to improve our understanding of external and internal health and safety issues associated with our activities.

Health, Safety and Environment Committee

The objective of the Committee is to provide opportunities for employees to participate in the on-going processes for the improvement of health, safety and environment in the workplace, with particular emphasis on the identification and management of hazards.

The committee shall be comprised of at least the following members:

Scott Base – Summer

Services Supervisor, Chair Engineering Representative Programme Support Representative Technical Support ,Winter Domestic

Scott Base – Winter

Winter Leader, Chair Engineering Supervisor Technical Support Winter Domestic ,AHT Conservator

Other members of staff that wish to participate in the work of the committee are welcome to join. Incident, Near Miss and Hazard Reporting Management of risk is a continuous process and the cornerstone of all Health and Safety elements. We will regularly identify the hazards and assess the risks associated with all our activities.

We are committed to each other's safety. All incidents, near misses and hazards will be reported, assessed and if required investigated so that we can learn from previous experience and improve our performance. Our investigation will focus on identifying root causes and / or system failures.

Appendix B: BAS Health and Safety Policy Statement (7 October , 2013)

The British Antarctic Survey (BAS) is a world class polar research organization based in Cambridge, UK and predominantly operates in the Antarctic and the Arctic. The polar regions present many health and safety hazards not normally encountered in the everyday workplace. For this reason the key to our continued safe operation and success is our highly skilled and experienced staff. The BAS senior management places the highest priority on the health and safety of our staff, and as a consequence is dedicated to strong and active health and safety leadership.

BAS are committed to:

. Developing and maintaining a pragmatic, positive and open culture where health and safety are recognised by all staff to be fundamental in all we do.

. Complying with, and where possible exceeding, all our legal obligations for health and safety, both in the UK and overseas.

. Continuously improving our health and safety performance.

. Maintaining our accreditation to the British Standard OHSAS 18001 and the International Aviation Council's IS-BAO safety management standards, and fulfilling the legal requirements of the International Maritime Organisation's ISM code.

The parent organisation of BAS is the Natural Environment Research Council (NERC), and therefore BAS also operates to the NREC.BAS will:

- Implement a health and safety management system which sets demanding health and safety objectives and targets. This includes assigning clear health and safety management responsibilities.
- Identify the hazards and assess the risks created by our activities, and so far as is reasonably practicable eliminate or control those risks.
- Provide our staff with the information and training necessary for them to carry out their jobs safely.
- Appoint competent people to provide specialist health and safety advice to line managers and staff.
- Consult our staff, collaborators and union appointed safety representatives on HSE matters.
- Manage the health and safety of all contractors and visitors (including visiting scientists and students) to our sites and ships.

- review our health and safety performance at regular intervals to identify where improvements are necessary, and implement plans to achieve those improvements as soon as possible.

As far as is reasonably practicable we will seek to apply the same high standards to our operations overseas as we do to our work in the United Kingdom. In particular, in Antarctica BAS adopts a twenty four hour, seven day a week duty of care for our staff and others working on our stations, ships and in the field.
The organisational arrangements for achieving this policy are set out in the BAS Safety Management Documentation.
Signed:

Prof. Jane Francis, Director
Date: 7 October 2013

Auditing

1.1. Health and safety auditing is a process whereby organisations can review and continuously evaluate the effectiveness of their safety management systems BAS has 3 categories for health and safety audits: -
    - Ships ISM Auditing
    - Aircraft operations IS-BAO Auditing
    - General Health and Safety Management BS 18001 OHSAS Auditing

A strategy that could be adopted would be the QSG. It is my opinion after having been a PCAS student and down to Antarctica for the field component that a strategy such as a QSG and its implementation in a systematic manor would be highly beneficial to prevent injuries of the musculoskeletal nature, such as “strains and sprains” . (the system of implementation is covered in the Part ,,,,)

Bi-annual auditing has enabled

Risk management from the data of BAS board review

a. **Risk assessment.** The BAS risk assessment process continues to need development. For such a complex organisation we need to improve our process to manage risk assessment and its outcomes. Risk assessment needs to be central and current to the BAS business processes and all new work should be captured. A new system to cover

the routine risk assessment for BAS stations and Cambridge is under development and a trial of the system will take place for the new Halley VI site.

5.1 BAS has a number of means to ensure staff involvement and consultation with matters which involve their health and safety : -

a. The BAS Health and Safety Committee
b. The BAS Safety Health and Environment Management Team (SHEMT)
c. Local Safety Meetings/ committees on stations and ships
d. Line management communication and consultation is a line management responsibility.
e. The BAS H&S web site is used to communicate with and provide information to staff including minutes of all H&S meetings
f. H&S notice boards are used for local information
g. BAS annual 'Town Meeting' to champion H&S topics
h. The BAS annual report has a section reporting H&S performance
i. Health and Safety is a standing item on all BAS formal meetings

BAS Health and Safety Policy

1.1 The BAS Health and Safety policy statement (see annex 1) is reviewed annually and submitted to the BAS Board for approval. It is signed by the Director then made available to staff through the BAS Web and the H&S intranet site.

1.2 The BAS Health and Safety policy has evolved year by year; the latest version reflects the change to the scope of BAS science and operational work.

1.3 The new PSPE science programme has made some adjustments to the management structure with regards to responsibility for safety management. A key statement of the new policy is: -

> 'Primary responsibility for conducting risk assessments and ensuring control measures are in place lies with **BAS Work Package Managers** and **Group Heads**. It is their responsibility to ensure risk assessment and safe systems of work are put into practice and in due course document risk assessments and procedures in the BAS corporate database.

1.4 The 'Work Package Managers' are key personnel with responsibility for the health and safety management of science activities. The NERC policy applies to Work Package Managers and requires that they must complete the *Safety Management in a Research Environment* course developed by NERC (2.5 days).

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